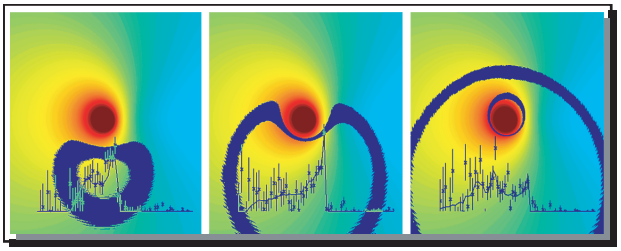
Constellation-X MISSION FACT SHEET

Constellation-X will use X-ray Spectroscopy to revolutionize our knowledge of the universe. It will probe closer to black hole event horizons with 100 times better sensitivity than ever before.

Constellation-X's four science objectives are tightly connected to NASA SEU themes:



I. Measure the effects of **strong gravity** near the event horizon of supermassive black holes.
What is the nature of space and time?
What powers supermassive black holes?

II. Trace visible matter throughout the universe and constrain the nature of **dark matter** and dark energy.
What is the universe made of?
How does the universe evolve?

III. Study the formation of supermassive **black holes** and trace their evolution with cosmic time.
What roles do they play in galaxy evolution?
What is the total energy output of the universe?

IV. Study the **life cycles of matter** and energy and understand the behavior of matter in extreme environments.
What new forms of matter will be discovered?
How does the chemical composition of the universe evolve?

Well-defined science objectives provide well-defined measurement requirements.

Management: A straightforward approach with few interfaces and highly experienced teams:

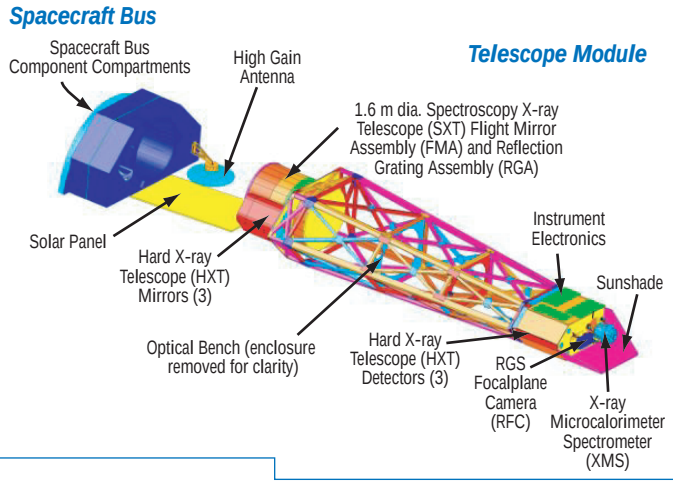
- Mission managed by NASA/GSFC
- SAO part of management team
- Prime contractor for observatory

Mission Overview:

Launch dates:	2010 and 2011
Launch vehicles:	Atlas V (two)
Constellation:	4 observatories point at target (no formation flying)
Mission lifetime:	4 years for fully operational constellation & 10 year goal
Orbit:	L2 Lissajous
NASA mission cost:	$1,597B (RY)

Exploded view of a Constellation-X observatory

- Robust, modular mission design
- Performance verifiable on the ground
- Meets mission requirements traceable to the science objectives



Constellation-X provides:

High observing efficiency (90%)
Large sample sizes of key astrophysical objects
Broad-band X-ray imaging spectroscopy (0.25 - 40 keV)
General observer facility with programs selected by peer review to carry out world-class science
Dramatic improvements in spectroscopic sensitivity, about a factor of 100 over previous missions

Observatory Characteristics:

Number:	4 identical observatories
Wet mass (each):	~2480 kg
Power (each):	~1075 W
Data storage:	42 Gbit
Source location:	5 arcsec, post facto
Attitude control:	3-axis stabilized ~30 arcsec control
Communication:	X/S-band downlink (1.7 Mbps/2 kbps) S-band uplink (2 kbps)
Mechanisms:	Few; low precision focusing

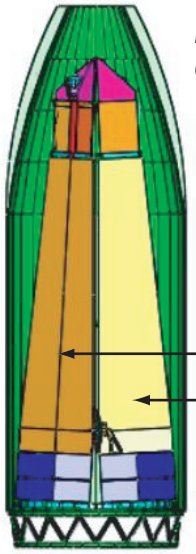
No new spacecraft technologies are required

Modular design minimizes interfaces and simplifies I&T flow

Key Heritage Elements:

- Technologies evolve from existing hardware.
- Our teams bring significant flight experience.
- Chandra provides heritage for systems engineering, key mechanisms, I&T, and the Science and Operations Center.

Technology Area	*Current TRL*	*Date for TRL6*	*Heritage*
Mirrors (SXT, HXT)	3/4	FY06	*ASCA*, Astro-E2, InFocμs *Chandra, XMM-Newton*
XMS Microcalorimeter	4	FY05	Astro-E2
HXT detector	4/6	FY05	HEFT, InFocμs
RGS CCDs	3	FY05	*ASCA, Chandra*
RGS gratings	3	FY06	*XMM-Newton*
XMS Cryocooler	4	FY06	*HST, TES, AIRS*
XMS ADR	4	FY06	Astro-E2



Resource margins are based on a mature mission concept

Mass Margin:	34%
Power Margin:	34%
Schedule Contingency:	5 months (10%) (plus slack)
Cost Reserves: (observatory development)	$191M (22%)

Observatory 1

Observatory 2

Two observatories are packaged inside an Atlas V fairing

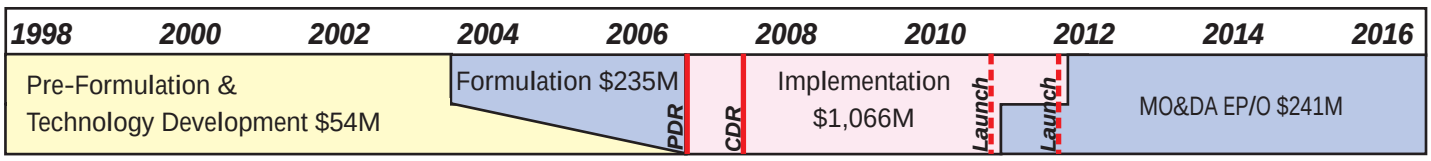
Science Payload: Instruments are extensions of recent, flight-proven hardware, minimizing technology development risks while meeting requirements with adequate performance margins.

SXT FMA:	Primary optic feed for XMS and RGS ≈15,000 cm^2 at 1.25 keV
RGS:	Dispersive spectrometer from 0.25 - 2 keV Resolving power R ≈300 at 0.6 keV
XMS:	Imaging spectrometer from 0.6 - 10 keV Resolving power R ≈ 1500 at 6.0 keV
HXT:	Imaging spectrometer from 6 - 40 keV Resolving power R ≈10 at 40 keV

Why Constellation-X Now?

- Guaranteed, compelling science returns
- Breakthrough discoveries require comprehensive spectroscopic studies
- Addresses priorities of the NASA SEU program
- Technology development has demonstrated readiness to proceed; team is in place

Constellation-X Schedule



RY DOLLARS